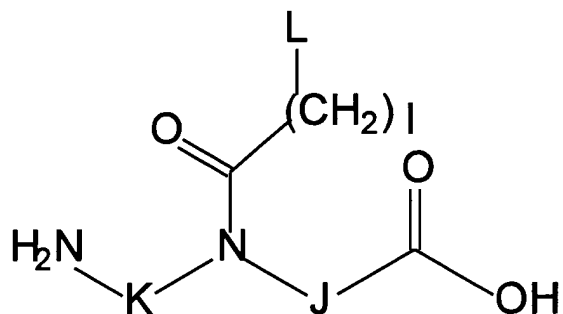
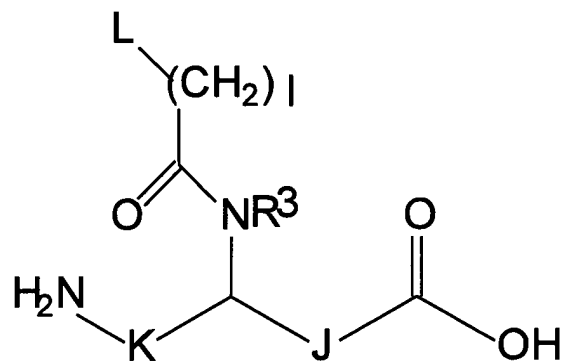


said peptide nucleic acid having a backbone;  
said backbone having an amino end, a carboxyl end, a plurality of amino groups, and a conjugate bound directly or through a linking moiety to at least one of said amino end or said carboxyl end;  
said amino groups each having a tethered nucleobase; and  
said conjugate being a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator;  
wherein said crosslinking agent is not lysine.

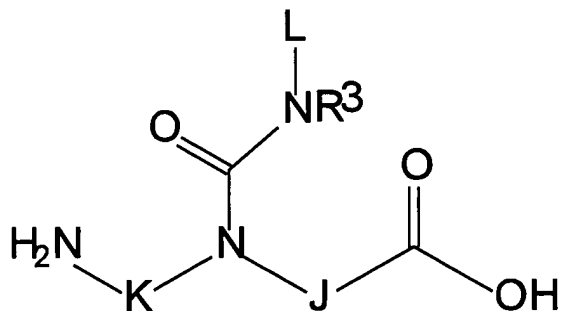
30. (Twice amended) A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;  
 $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$l$  is an integer from 1 to 5; and

at least one of  $L$  and  $R3$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; [and compare]

wherein said conjugate optionally includes a linking moiety.

$$\left[ \begin{array}{c} \text{L}_m \\ | \\ \text{A}_m \\ | \\ \text{B}_m \\ / \quad \backslash \\ \text{Q} \quad \text{C}_m \quad \text{D}_m \end{array} \right] \text{G}_m \text{C} \begin{array}{c} \text{L} \\ | \\ \text{A} \\ | \\ \text{B} \\ / \quad \backslash \\ \quad \text{C} \quad \text{D} \end{array} \quad m$$

a is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup>, SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

wherein R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl; and

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio- substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino;

D and D<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>;

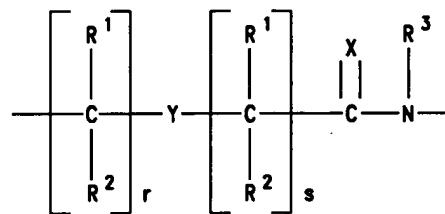
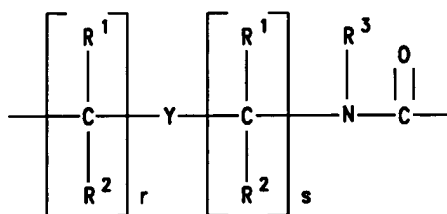
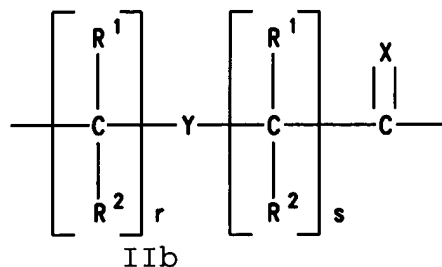
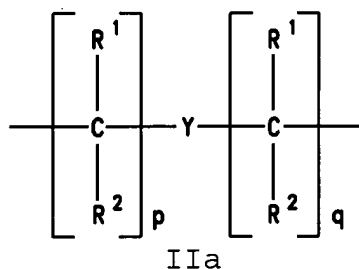
each of y and z is zero or an integer from 1 to 10, wherein the sum y + z is greater than 2 but not more than 10;

G<sub>m</sub> is independently -NR<sup>3</sup>CO-, -NR<sup>3</sup>CS-, -NR<sup>3</sup>SO-, or -NR<sup>3</sup>SO<sub>2</sub>- in either orientation;

each pair of A-A<sub>m</sub> and B-B<sub>m</sub> are selected such that:

(a) A or A<sub>m</sub> is a group of formula (IIa), (IIb) or (IIc) and B or B<sub>m</sub> is N or R<sup>3</sup>N<sup>+</sup>; or

(b) A or A<sub>m</sub> is a group of formula (IIId) and B or B<sub>m</sub> is CH;



wherein:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a

nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate; Q is  $-\text{CO}_2\text{H}$ ,  $-\text{CO}_2\text{R}^8$ ,  $-\text{CO}_2\text{R}^9$ ,  $-\text{CONR}^8\text{R}^9$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{SO}_2\text{NR}^{10}\text{R}^{11}$  or an activated derivative of  $-\text{CO}_2\text{H}$  or  $-\text{SO}_3\text{H}$ ; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

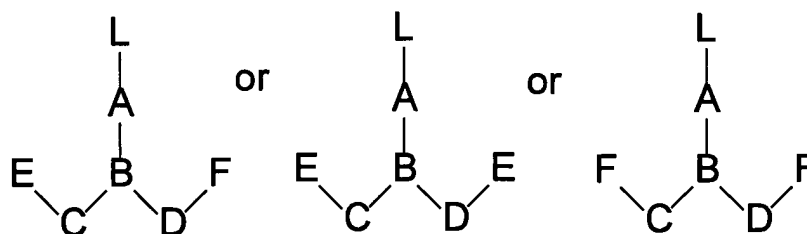
at least one of A,  $A_m$ , L, and  $L_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein when said Q or I is a crosslinking agent, said crosslinking agent is not lysine.



38. (Amended) A compound having one of the following formulas:



wherein:

L is  $\text{R}^{12}(\text{R}^{13})_a$ ; wherein:

$\text{R}^{12}$  is hydrogen, hydroxy,  $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $\text{R}^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

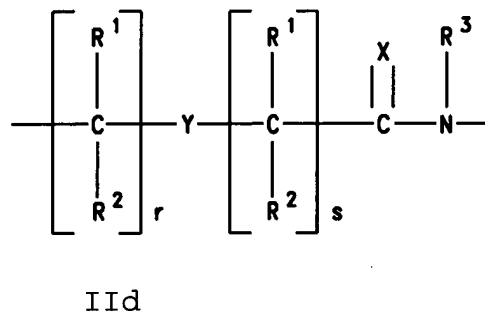
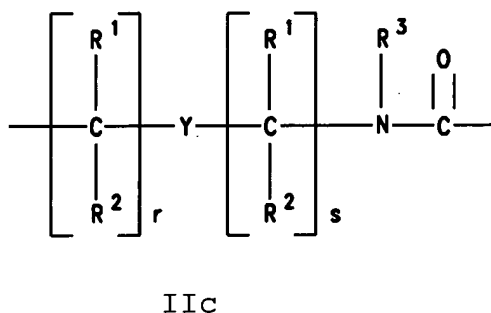
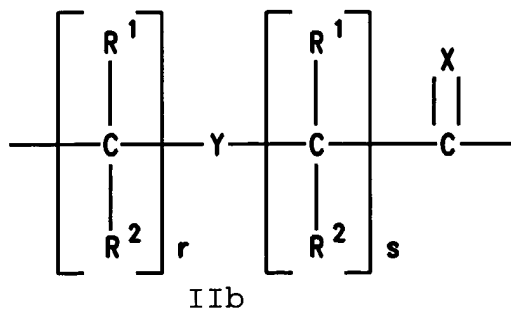
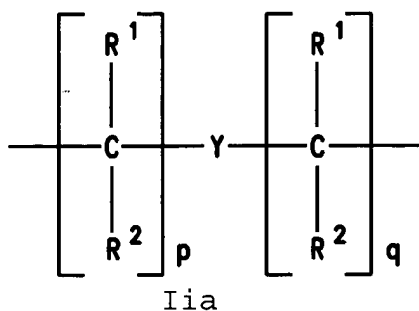
$\text{R}^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $\text{R}^3\text{N}^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino; and  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

E independently is  $COOH$ ,  $CSOH$ ,  $SOOH$ ,  $SO_2OH$  or an activated or protected derivative thereof;

F independently is  $NHR^3$  or  $NPgR^3$ , where Pg is an amino protecting group;

[wherein:] or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a

---

Please add new claims 39-49 as indicated below:

Chemical structure of a polycondensate repeat unit, enclosed in brackets with a subscript  $m$ . The structure shows a central chain:  $Q-C_m-B_m-D_m-G_m-C-B-D$ . Above  $B_m$  is  $A_m$ , and above  $A_m$  is  $L_m$ . Above  $B$  is  $A$ , and above  $A$  is  $L$ . The chain continues from  $Q$  and  $D$ .

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA

intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

C and  $C_m$  independently are  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio- substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

D and  $D_m$  independently are  $(CR^6R^7)_z$ ;

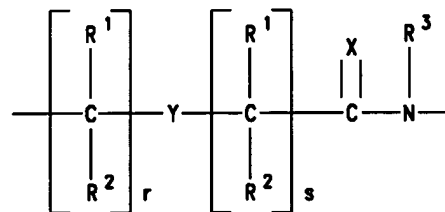
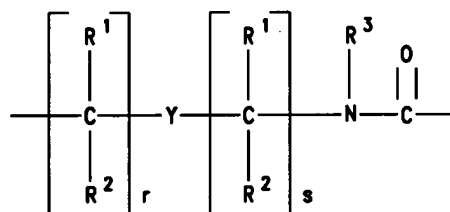
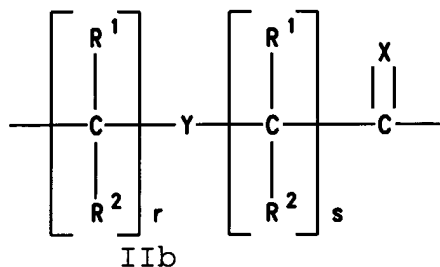
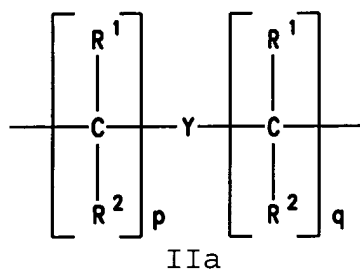
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IIId) and  $B$  or  $B_m$  is  $CH$ ;



wherein:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of  $r$  and  $s$  is zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen,  $(C_1-C_4)$ alkyl, hydroxy-substituted  $(C_1-C_4)$ alkyl, alkoxy-substituted  $(C_1-C_4)$ alkyl, alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is  $-NR^8R^9$  or  $-NR^{10}C(O)R^{11}$ ; wherein:

$R^8$ ,  $R^9$ ,  $R^{10}$  and  $R^{11}$  independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is  $-CO_2H$ ,  $-CO_2R^8$ ,  $-CO_2R^9$ ,  $-CONR^8R^9$ ,  $-SO_3H$ ,  $-SO_2NR^{10}R^{11}$  or an activated derivative of  $-CO_2H$  or  $-SO_3H$ ; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A,  $A_m$ , L, and  $L_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

---

wherein said conjugate optionally includes a linking moiety;  
and

wherein when said Q or I is a crosslinking agent, said crosslinking agnt is not lysine.

Chemical structure diagram of a polycondensate repeat unit, enclosed in large square brackets with a subscript  $m$  at the bottom right. The structure shows a sequence of atoms:  $Q - C_m - B_m - D_m - G_m - C - B - D$ . The  $C_m$ ,  $B_m$ , and  $D_m$  atoms are part of a methacrylate-like group, with  $C_m$  bonded to  $Q$  and  $B_m$ ,  $B_m$  bonded to  $A_m$  and  $D_m$ , and  $D_m$  bonded to  $G_m$ .  $A_m$  is bonded to  $L_m$ . The  $C$ ,  $B$ , and  $D$  atoms are part of an acrylate-like group, with  $C$  bonded to  $G_m$  and  $B$ ,  $B$  bonded to  $A$ , and  $D$  bonded to an unspecified group.  $A$  is bonded to  $L$ .

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA



intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

C and  $C_m$  independently are  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio- substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

D and  $D_m$  independently are  $(CR^6R^7)_z$ ;

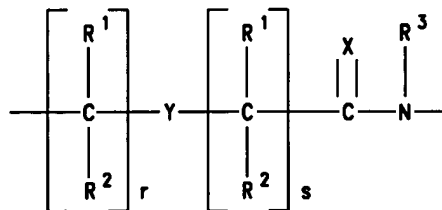
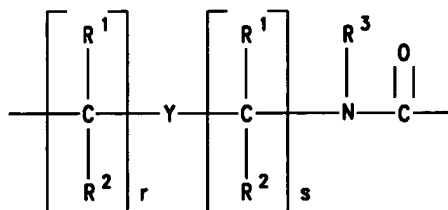
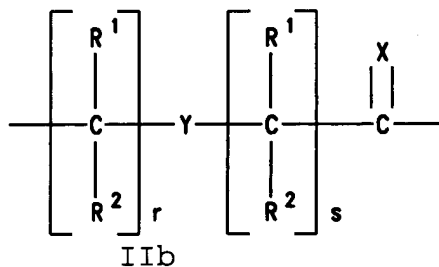
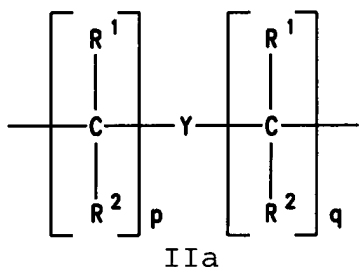
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IIId) and  $B$  or  $B_m$  is  $CH$ ;



wherein:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of  $r$  and  $s$  is zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen,  $(C_1-C_4)$ alkyl, hydroxy-substituted  $(C_1-C_4)$ alkyl, alkoxy-substituted  $(C_1-C_4)$ alkyl, alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is  $-NR^8R^9$  or  $-NR^{10}C(O)R^{11}$ ; wherein:

$R^8$ ,  $R^9$ ,  $R^{10}$  and  $R^{11}$  independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is  $-CO_2H$ ,  $-CO_2R^8$ ,  $-CO_2R^9$ ,  $-CONR^8R^9$ ,  $-SO_3H$ ,  $-SO_2NR^{10}R^{11}$  or an activated derivative of  $-CO_2H$  or  $-SO_3H$ ; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A,  $A_m$ , L, and  $L_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

---

wherein when said Q or I is a crosslinking agent, said crosslinking agnt is not lysine.

$$\left[ \begin{array}{c} \text{L}_m \\ | \\ \text{A}_m \\ | \\ \text{B}_m \\ / \quad \backslash \\ \text{Q} \quad \text{C}_m \quad \text{D}_m \quad \text{G}_m \end{array} \right]_m \quad \begin{array}{c} \text{L} \\ | \\ \text{A} \\ | \\ \text{B} \\ / \quad \backslash \\ \text{C} \quad \text{D} \end{array}$$

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, ~~an aromatic moiety, a DNA~~

intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

C and  $C_m$  independently are  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio- substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

D and  $D_m$  independently are  $(CR^6R^7)_z$ ;

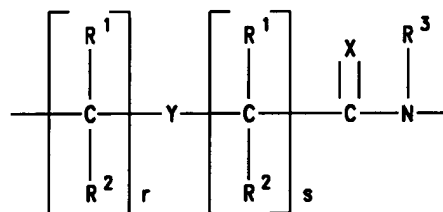
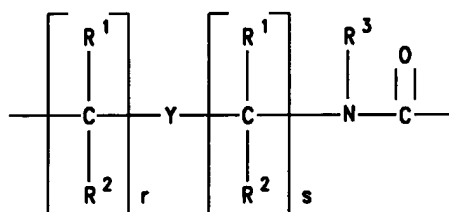
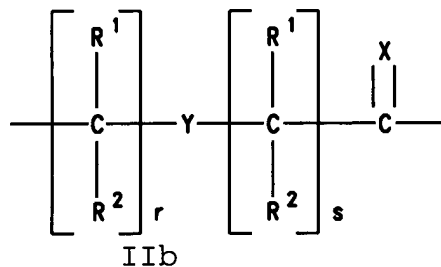
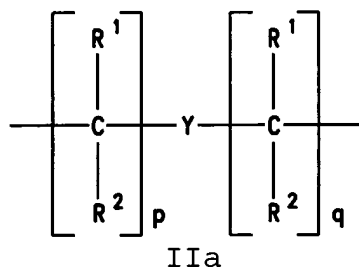
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IIId) and  $B$  or  $B_m$  is  $CH$ ;



wherein:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of  $r$  and  $s$  is zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen,  $(C_1-C_4)$ alkyl, hydroxy-substituted  $(C_1-C_4)$ alkyl, alkoxy-substituted  $(C_1-C_4)$ alkyl, alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is  $-NR^8R^9$  or  $-NR^{10}C(O)R^{11}$ ; wherein:

$R^8$ ,  $R^9$ ,  $R^{10}$  and  $R^{11}$  independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is  $-CO_2H$ ,  $-CO_2R^8$ ,  $-CO_2R^9$ ,  $-CONR^8R^9$ ,  $-SO_3H$ ,  $-SO_2NR^{10}R^{11}$  or an activated derivative of  $-CO_2H$  or  $-SO_3H$ ; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A,  $A_m$ , L, and  $L_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

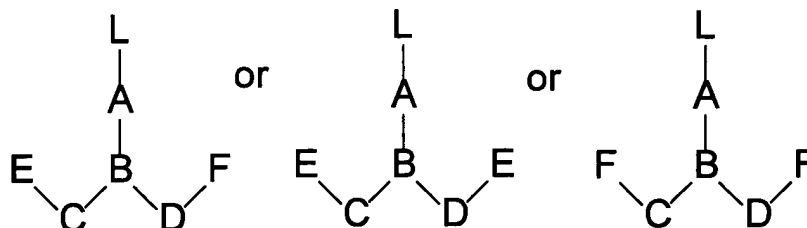
complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety;  
and

wherein at least one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$  and  $R^7$  is a conjugate;  
and

wherein when said Q or I is a crosslinking agent, said crosslinking agent is not lysine.

42. A peptide nucleic acid conjugate of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$



is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

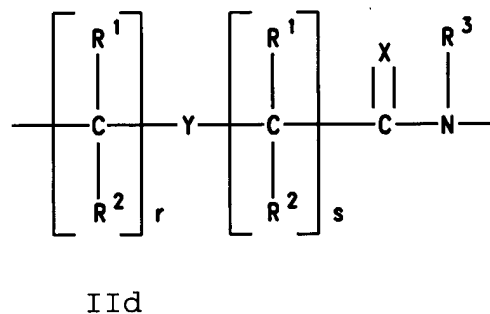
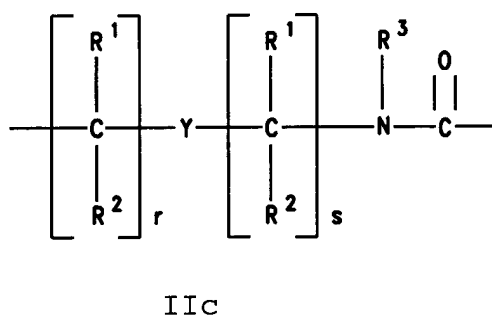
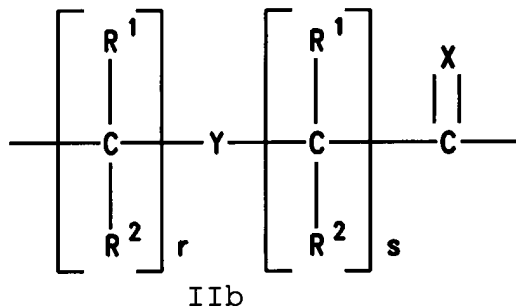
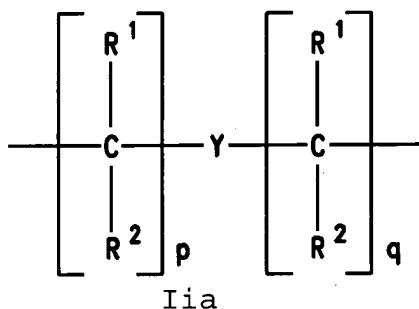
$R^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

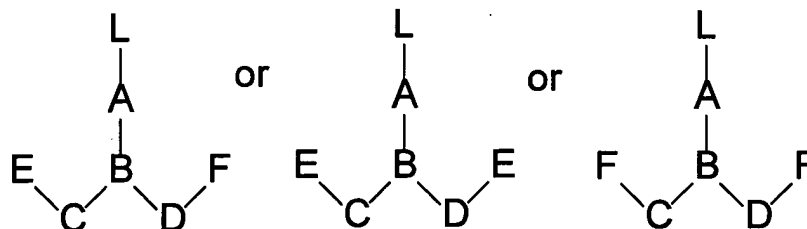
F independently is  $\text{NHR}^3$  or  $\text{NPgR}^3$ , where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one group  $\text{R}^3$  is a conjugate.

43. A peptide nucleic acid conjugate of formula:



wherein:

L is  $\text{R}^{12}(\text{R}^{13})_a$ ; wherein:

$\text{R}^{12}$  is hydrogen, hydroxy,  $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $\text{R}^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

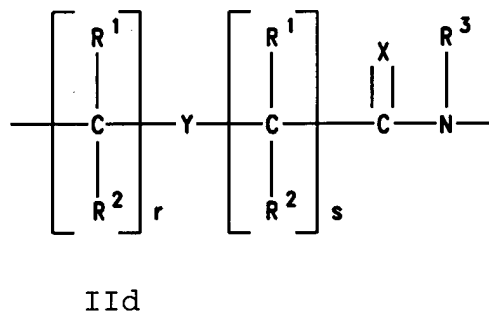
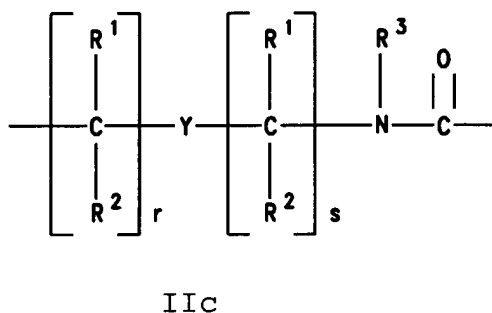
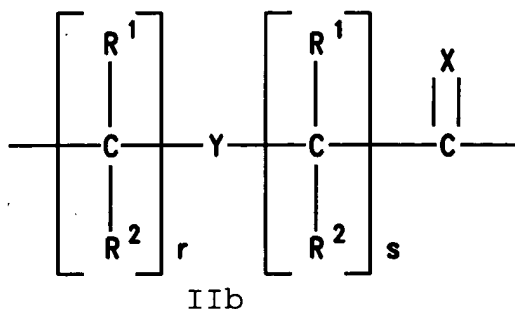
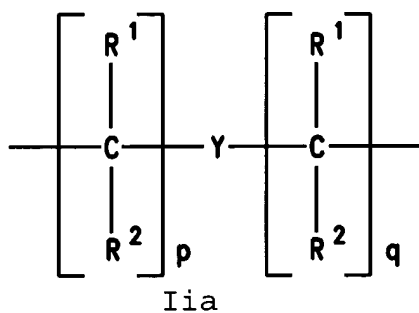
$\text{R}^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $\text{R}^3\text{N}^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen,  $(C_1-C_4)$ alkyl, hydroxy-substituted  $(C_1-C_4)$ alkyl, alkoxy-substituted  $(C_1-C_4)$ alkyl, alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is  $(CR^6R^7)_y$ ;

D is  $(CR^6R^7)_z$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino; and  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$E$  independently is  $COOH$ ,  $CSOH$ ,  $SOOH$ ,  $SO_2OH$  or an activated or protected derivative thereof;

$F$  independently is  $NHR^3$  or  $NPgR^3$ , where  $Pg$  is an amino protecting group; or

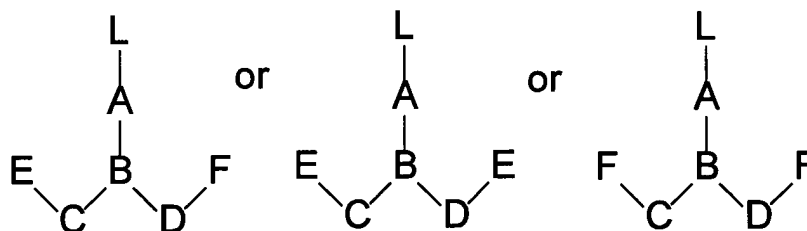
$F$  comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of  $A$  and  $L$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a

---

phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and wherein at least one of said groups A or said groups B include a conjugate.

44. A peptide nucleic acid conjugate of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$

is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

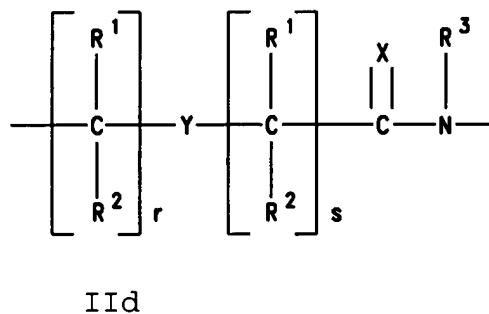
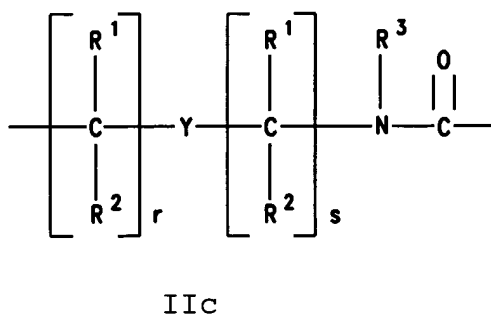
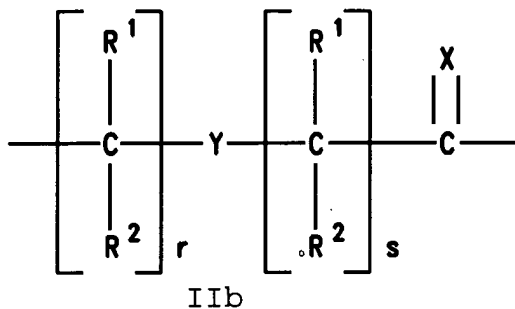
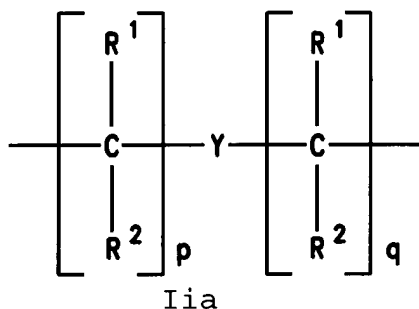
$R^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;



p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

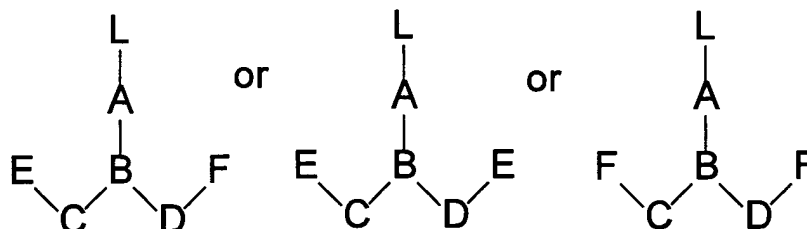
E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is  $\text{NHR}^3$  or  $\text{NPgR}^3$ , where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and  
wherein at least one of group  $\text{R}^1$  or group  $\text{R}^2$  is a conjugate.

45. A peptide nucleic acid conjugate of formula:



wherein:

L is  $\text{R}^{12}(\text{R}^{13})_a$ ; wherein:

$\text{R}^{12}$  is hydrogen, hydroxy,  $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $\text{R}^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

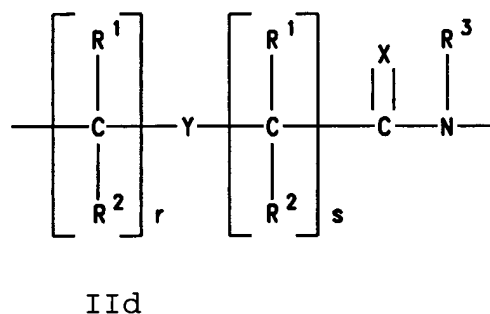
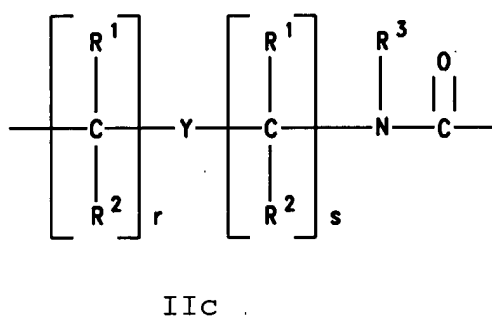
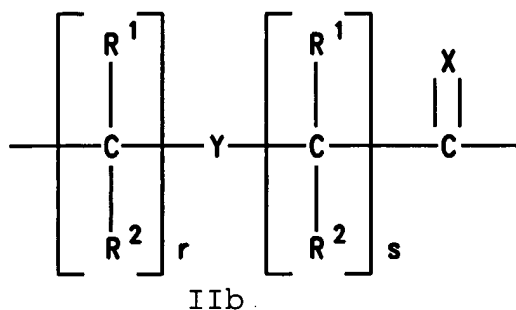
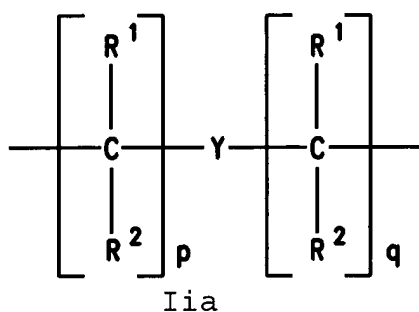
$\text{R}^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $\text{R}^3\text{N}^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino; and  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$E$  independently is  $COOH$ ,  $CSOH$ ,  $SOOH$ ,  $SO_2OH$  or an activated or protected derivative thereof;

$F$  independently is  $NHR^3$  or  $NPgR^3$ , where  $Pg$  is an amino protecting group; or

$F$  comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

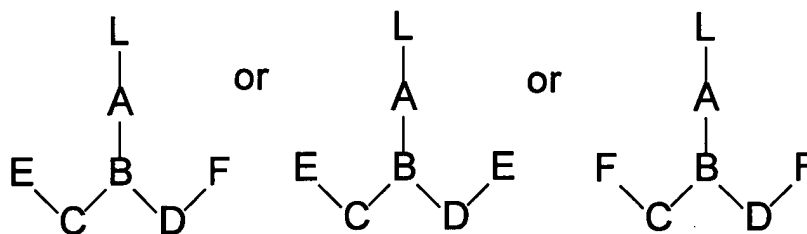
at least one of  $A$  and  $L$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a

---

phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ , and  $R^7$  is a conjugate.

46. A peptide nucleic acid conjugate of formula:



wherein:

$L$  is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally

occurring nucleobase, a DNA intercalator, or a  
nucleobase-binding group;

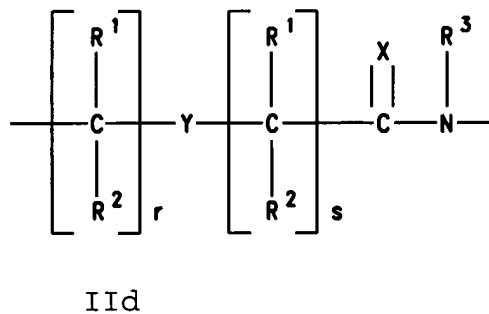
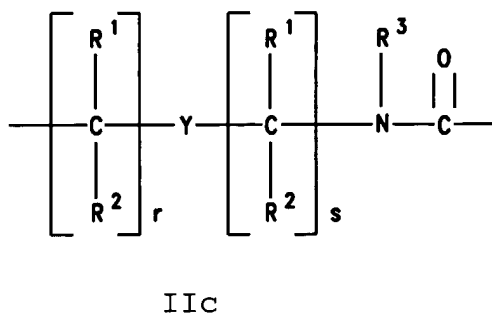
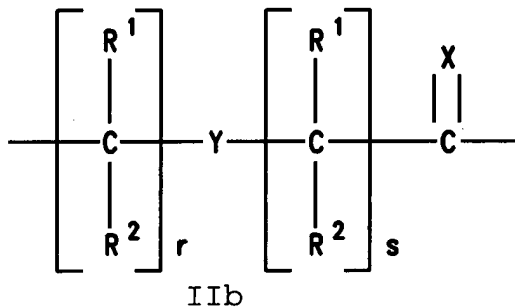
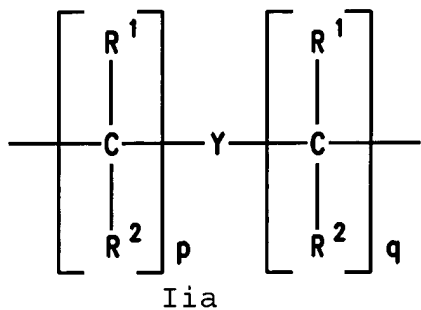
$R^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is  
N or  $R^3N^+$ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

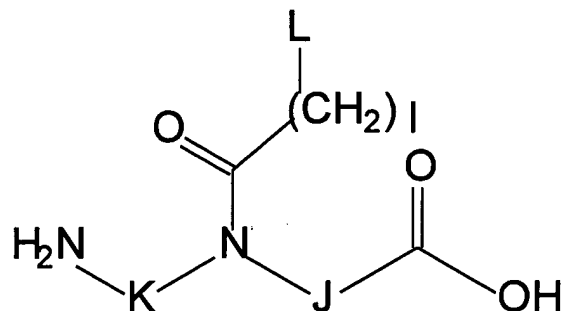


F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

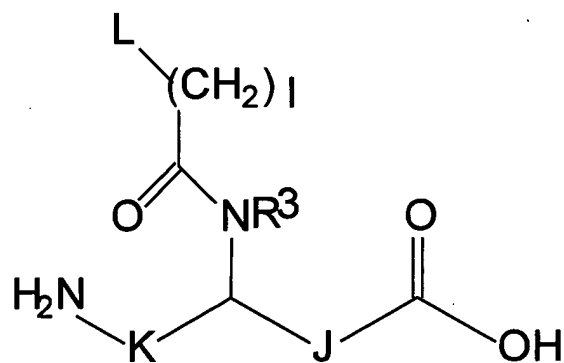
at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups C or said groups D include a conjugate.

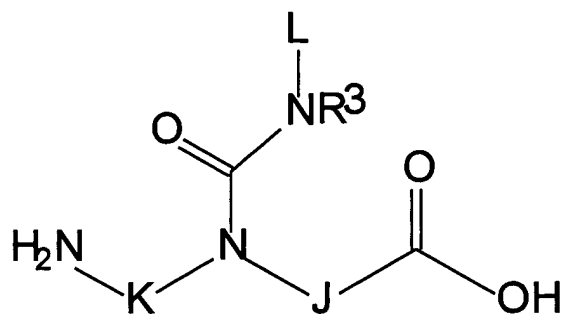
47. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

---

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-,  
alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum  
y + z being greater than 2 but not more than 10;

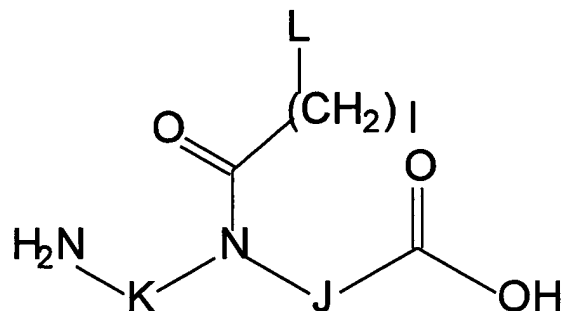
l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from  
a reporter enzyme, a reporter molecule, a steroid, a carbo-  
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell  
receptor binding molecule, a crosslinking agent, a water soluble  
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a  
metal chelator, a porphyrin, an alkylator, or a polymeric  
compound selected from polymeric amines, polymeric glycols and  
polyethers;

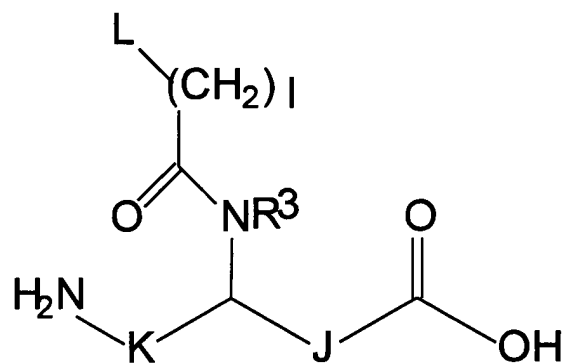
wherein said conjugate optionally includes a linking moiety;  
and

wherein at least one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ , and  $R^7$  is a conjugate.

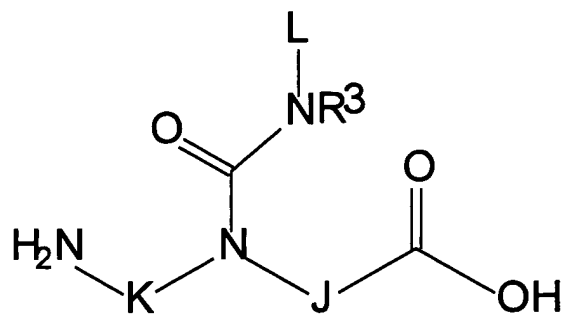
48. A peptide nucleic acid conjugate comprising a plurality  
of PNA monomers wherein at least one of said PNA monomers has the  
formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

---

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-,  
alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  
 $y + z$  being greater than 2 but not more than 10;

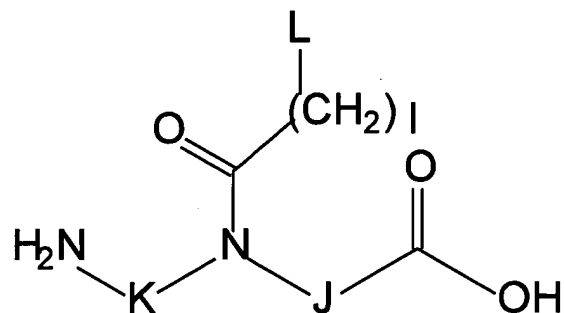
$l$  is an integer from 1 to 5; and

at least one of  $L$  and  $R_3$  comprises a conjugate selected from  
a reporter enzyme, a reporter molecule, a steroid, a carbo-  
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell  
receptor binding molecule, a crosslinking agent, a water soluble  
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a  
metal chelator, a porphyrin, an alkylator, or a polymeric  
compound selected from polymeric amines, polymeric glycols and  
polyethers;

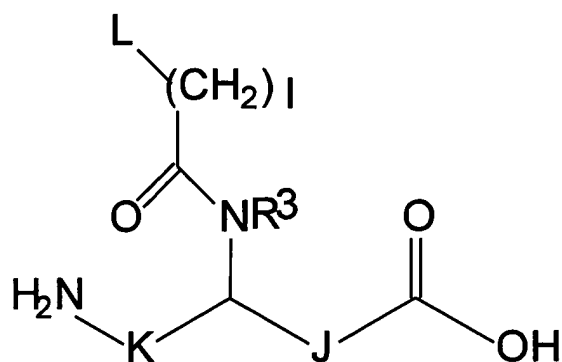
wherein said conjugate optionally includes a linking moiety;  
and

wherein at least one of said group  $K$  or said group  $J$   
includes a conjugate.

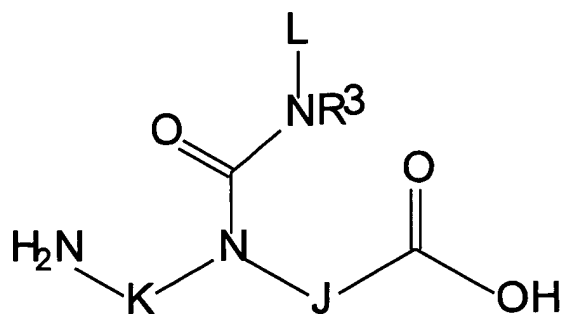
49. A peptide nucleic acid conjugate comprising a plurality  
of PNA monomers wherein at least one of said PNA monomers has the  
formula:



or formula:



or formula:





wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy,  $(C_1-C_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

---

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-,  
alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum  
y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from  
a reporter enzyme, a reporter molecule, a steroid, a carbo-  
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell  
receptor binding molecule, a crosslinking agent, a water soluble  
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a  
metal chelator, a porphyrin, an alkylator, or a polymeric  
compound selected from polymeric amines, polymeric glycols and  
polyethers;

wherein said conjugate optionally includes a linking moiety;  
and

wherein said group  $R^3$  is a conjugate.--

#### REMARKS

After entry of the proposed amendment, claims 1-6, 8-10, 12,  
13, 15-20, 22-24, 30-33, and 37-49 will be pending in this patent  
application.

Claims 1 and 37 have been amended to specify preferred  
embodiments of the present invention, and to further distinguish  
their subject matter from the subject matter of claims pending in